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## VEHICLE SUSPENSION

### FIELD OF THE INVENTION

The invention relates to a vehicle suspension, and in particular, one which forms part of the steering system. More preferably it relates to a front suspension and steering system.

### 5 BACKGROUND ART

It is also desirable to provide a compact and lightweight suspension system for small vehicles such as go-carts and ATV's.

Attempts to make suspension and steering systems for smaller vehicles such as go-carts and ATV's have resulted in movement of the plane of the wheels during steering, and vertical  
10 bump movement, resulting in the wheels either toeing in or toeing out.

### OBJECT OF THE INVENTION

It is an object of this invention to provide an improved steering-suspension system or one which at least provides the public with a useful choice.

### STATEMENT OF INVENTION

15 In one aspect the invention provides a steering and suspension system having a kingpin capable of being fixed relative to the vehicle chassis, and a shaft rotatable on the kingpin axis that is capable of being attached to a steering system. Preferably the steering and suspension system includes a component capable of attachment to a wheel via a stub axle or other means and also connectable to the rotatable shaft in such a manner that it can move in a similar  
20 vertical position to the kingpin axis.

In another aspect the invention provides an independent suspension-steering system as outlined above and further including a shock absorber.

In a yet further aspect the invention provides an independent steering-suspension system including a kingpin capable of being fixed relative to a vehicle chassis, a first member  
25 rotatable about the axis of the kingpin, a second member capable of being secured to the first member so that it is rotatable relative to the first member about an axis (which axis is

preferably normal to the axis of the kingpin) and also rotatable about the axis of the kingpin, a stub axle capable of being secured to the second member, a third member rotatable about the axis of the kingpin, whereby in use the independent steering-suspension system substantially eliminates toe and bump-steer.

- 5 Preferably the independent steering-suspension system as described above in the immediately preceding paragraph also includes a fourth member having a spring and damping elements and capable of being secured to the second and third members and preferably rotatable relative to the second and third members about axes normal to the axis of the kingpin and rotatable about the axis of the kingpin, and linkage means capable of  
10 transferring the steering effort to the first, second, third and fourth members as rotation about the kingpin axis, thereby providing steering action.

In its most preferred form the independent steering-suspension system is capable of use as the front suspension/steering system of a vehicle. More preferably the vehicle is a go-cart, ATV or other small vehicle. However the system of the invention can be used in vehicles of  
15 any size.

## **BRIEF DESCRIPTION OF DRAWINGS**

Various embodiments of the present invention are described, by way of example only, in the accompanying drawings.

Figure 1 illustrates the key members of the steering and suspension system.

- 20 Figure 2 illustrates a further embodiment on the invention where the members are combined to form common members.

## **DESCRIPTION**

- In the following examples, the steering/suspension components will be described as if they were fixed to a vehicle chassis, as it is desirable to explain the operation of the  
25 steering/suspension system, when installed on a vehicle. However it will be appreciated that the invention covers the components, sold as a subassembly, or the components designed to be assembled together to form a subassembly, or to be assembled in situ on the vehicle.

### Example 1

Referring to Figure 1, the main attachment to the chassis of the steering and suspension components is by the king pin mounting (1). This is the axis about which the suspension members rotate.

- 5 The first member (2) is attached directly to a shaft rotating within the chassis attachment 1. The second member (3) is attached to (2) by means of a swivel joint or bush, allowing vertical movement of a stub axle (7) attached solidly to (3). The vehicle wheel is attached to this stub axle by a rotating hub assembly (8).

- 10 The third member (4) is attached to (2) and acts as the steering arm connection to the steering linkage and load transference support for the fourth member (5), a telescopic shock absorber and spring unit.

When the vehicle's steering wheel is turned, via the steering box, rack and pinion or direct linkage, the arm (4) is rotated by the track rod (6). As (4) is connected directly to (2) (3) and (5), the complete unit moves as one.

- 15 The steering mechanism of the vehicle can be set in a horizontal plane with (4). Any vertical movement of the wheel will not alter this plane as the movement is absorbed and taken up by the flexible attachment of (3) and (5) to (2) and (4).

- 20 As there is no vertical movement with (4) while it is being rotated there is no vertical arching of the attached steering track rod (6) and therefore no influence on the position of the attached wheel in relation to the centre line of the vehicle. Thus the common occurrence of the wheels toeing in or out, caused by the steering linkage, with vertical movement of the wheel is eliminated.

### Example 2

- 25 Referring to Figure 2, this embodiment of the invention combines members 1 and 3, plus members 2 and 4.

The attachment (1) is directly to the chassis.

Component (2) and (4) are physically joined together either permanently or attachably. This combined unit rotates about the axis of (1) and is moved via the track rod (6).

Vertical movement is achieved by (5), the fourth member moving inside (2). The shock absorber element is contained within (2) coupled with the spring, or alternatively the spring  
5 can be mounted externally over (5).

The second member (3) is attached to (5) and to this is mounted the stub axle (7).

### ADVANTAGES

The examples of this invention provide a compact combined steering/suspension system capable of being used as the front suspension for vehicles, whilst at the same time  
10 minimising the occurrence of "bump-steer" and eliminating any toe-in/out influence of the steering linkage.

### VARIATIONS

The two examples of this invention show two different ways of assembling the components to provide a combined steering/suspension system. A number of variations are possible  
15 whilst still allowing the vehicle's wheels to accommodate vertical movement, without toeing in or toeing out during steering. Although the primary use of the preferred examples is that of a front suspension and steering sub-assembly for a go-cart, ATV or other vehicle, it is equally possible that this sub-assembly could be used for rear wheel steering or for all wheel steering or for the steering of a single wheel of a motorcycle or tricycle.

20 It will therefore be appreciated that various alterations or modifications may be made to the foregoing without departing from the spirit or scope of this invention.